WILDFIRE EFFECTS EVALUATION PROJECT

APPENDIX D: WILDLIFE

UMPQUA NATIONAL FOREST

April 2003

Appendix D: Wildlife

Snag & Log Inventory Methodology

Large dead or dying trees (snags ≥10in dbh) were sampled at the landscape-scale using the methodology described in a General Technical Report (GTR) by Bate et al. (1999). This GTR provides an efficient and accurate sampling method for snags using rectangular plots, and is effective for sampling areas between 1,000-20,000 acres in size. Large down wood (logs ≥16in diameter at small end and ≥16ft length) were sampled along the snag transect centerlines using standard line-intersect sampling methodology (DeVries 1986, Waddell 2002).

Sampling Location and Stratification

The planning area for the Baked Apple timber salvage (approximately 14,000 acres – Figure 2D) was chosen for the pilot survey area. The "landscape" within it was stratified, as recommended in the GTR, into nine strata, using a combination of burn intensities and successional stages (Figure 1D).

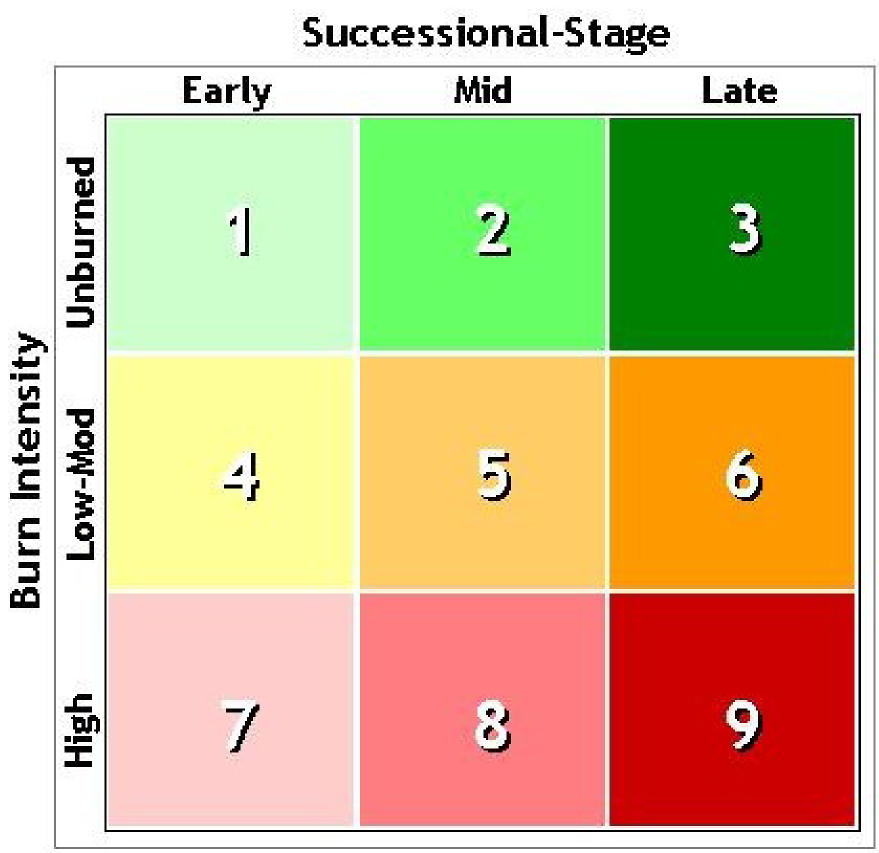

Figure 1D: Matrix used to Define Sampling Strata within the Pilot Survey Area

Within each of these strata, five transect starting-points were randomly selected following "Option 1" in the GTR, but using a random point generator in ArcView instead of overlaying a grid. Random azimuths were then generated for each starting-point, and if the resulting transect intersected a road or other strata, the point was dropped and the process repeated, until five points were generated for each strata (Figure 3D).

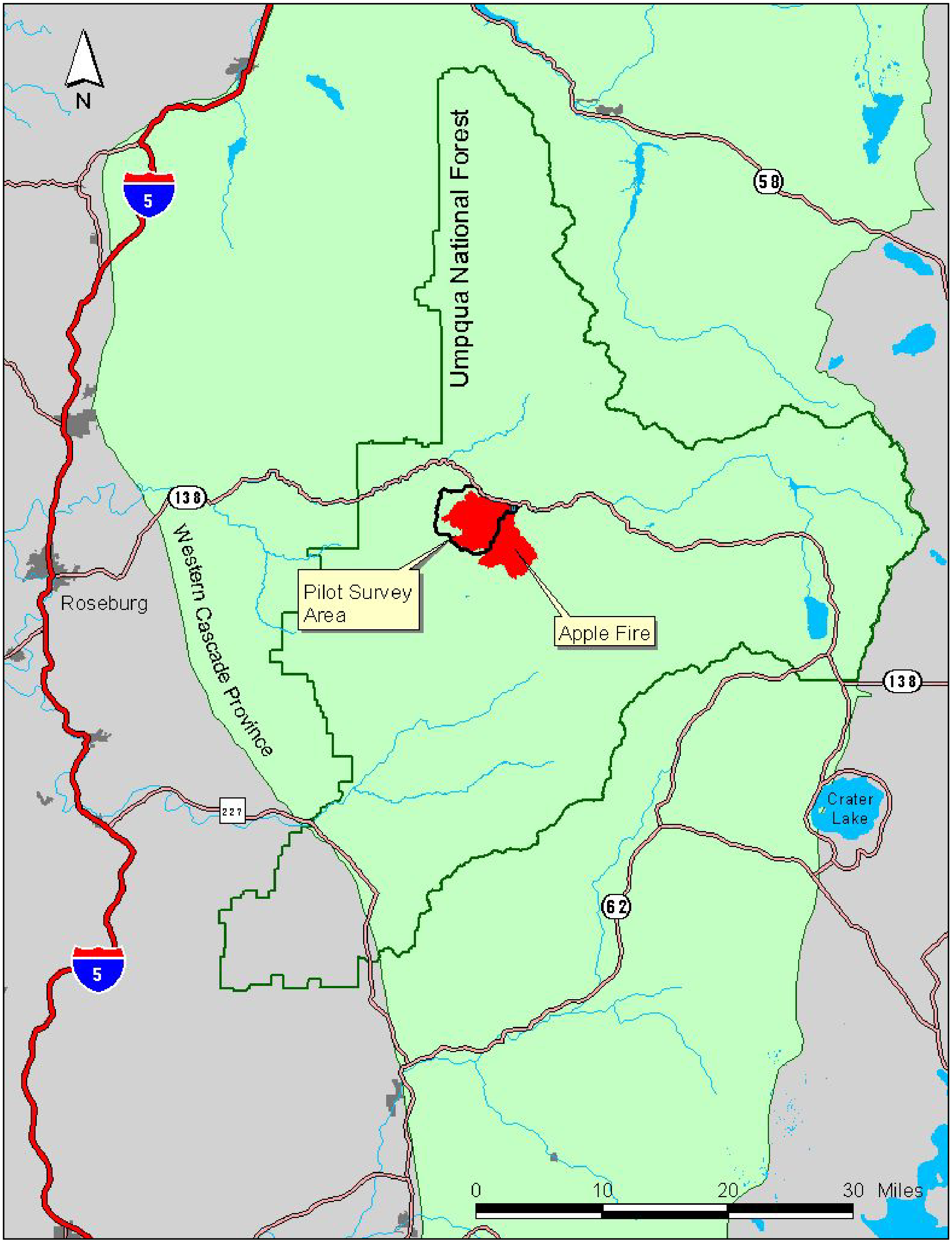

Figure 2D: Location Map of the Pilot Survey Area and the Associated Apple Fire of 2002

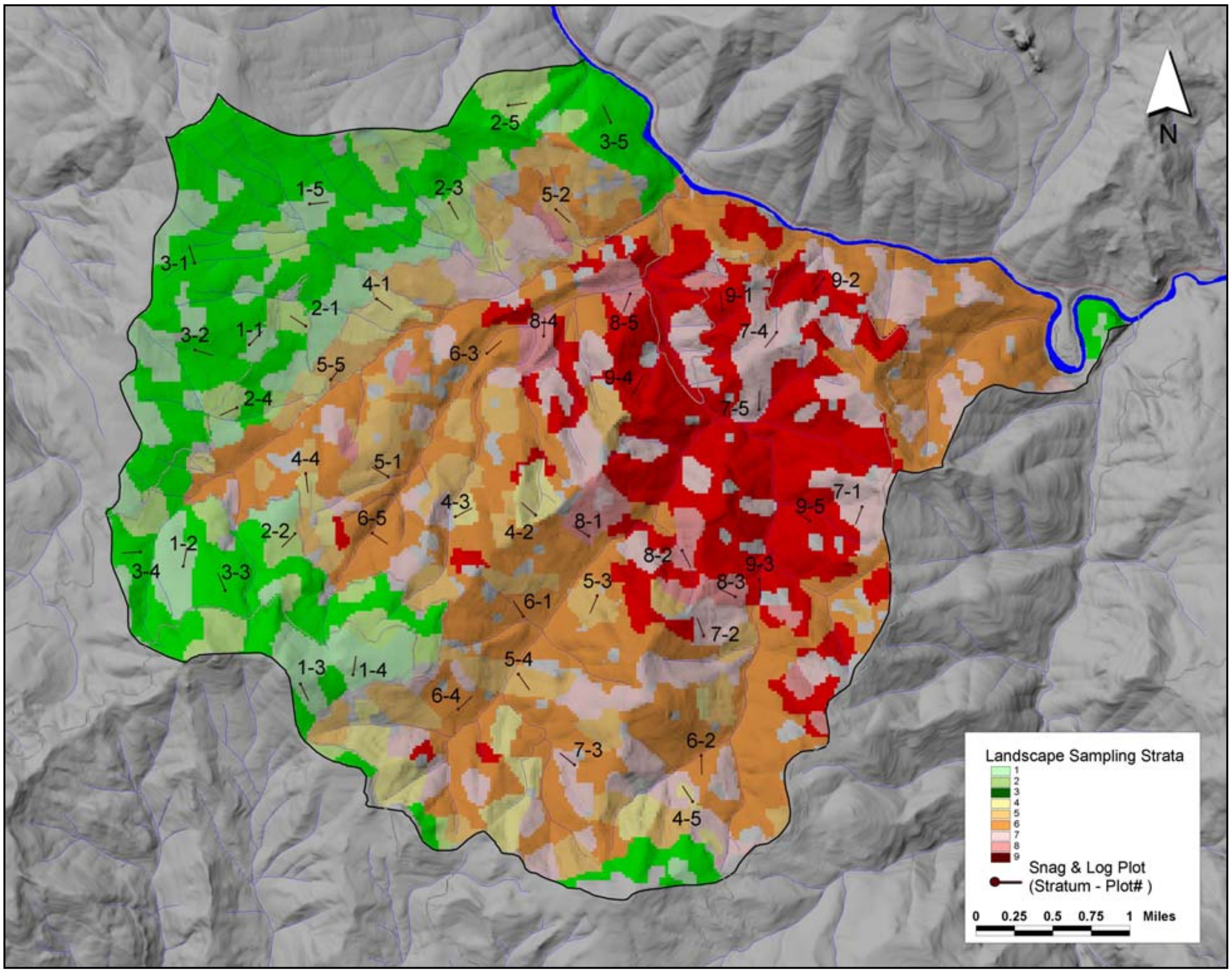

Figure 3D: Map of Sampling Stratum and Plot Locations within the Pilot-Survey Area

Because the Excel spreadsheets provided by the GTR for analysis of the data are currently designed to accommodate only 4 strata, each "burn intensity" area was analyzed separately (L. Bate personal communication). The means and variances for each of these areas were then used to calculate a mean and variance for the entire pilot survey area.

Plot Layout and Data Collection

Full transect widths of 132-ft were used for the pilot survey. Plot layout is described in Figure 4D. Husky Fex-21 field computers with a simple Microsoft Access database were used to collect snag, log and plot data. The data was then downloaded into a PC version MS Access database and then transferred to Excel. It was possible to calculate means and standard deviations using MS Access and then enter these values into the Excel spreadsheet for final statistical analyses.

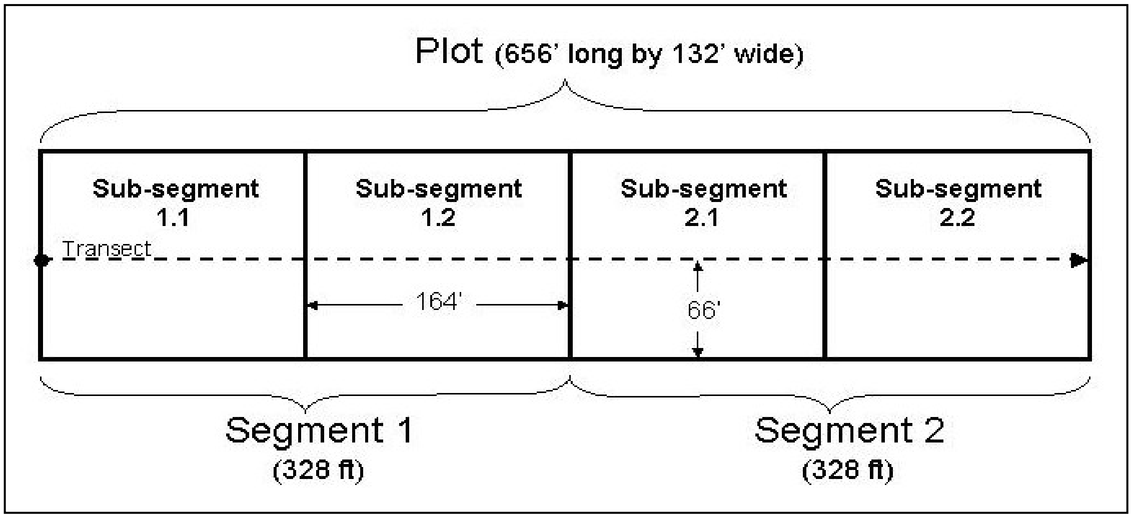

Figure 4D: Transect and Plot Design used to Conduct the Inventory (each sub-segment represents a 0.5-acre plot. All distances were corrected for slope)

Estimating Fire Mortality

Fire mortality was estimated on plots using probability of mortality information from Reinhardt and Ryan (1989). If the tree exhibited crown scorch (by volume) as shown in Table 1D, then it was assumed that the tree had a greater than 80% chance of dying and therefore was tallied as a snag. As an example, a 20-inch dbh Douglas-fir tree had to have 95% or more of its crown (by volume) scorched to be tallied as a snag. Larger Douglas-fir (≥22in dbh) needed 100% crown scorch to be tallied.

Table 1D: Crown Scorch Volume (%) used to Predict ≥80% Probability of Mortality

SPECIES	DIAMETER AT BREAST HEIGHT												
	10"	12"	14"	16"	18"	20"	22"	24"	26"	28"	30"	35"	40"
Douglas-fir	70%	75%	80%	85%	90%	95%	100%	100%	100%	100%	100%	100%	100%
Ponderosa Pine	65%	70%	75%	80%	85%	90%	95%	100%	100%	100%	100%	100%	100%
Sugar Pine	70%	80%	85%	90%	95%	100%	100%	100%	100%	100%	100%	100%	100%
White Fir	55%	60%	65%	70%	75%	80%	85%	90%	90%	95%	100%	100%	100%
Hemlock	50%	55%	60%	65%	70%	75%	75%	80%	85%	90%	95%	100%	100%
Cedar	50%	55%	60%	65%	65%	70%	75%	75%	80%	85%	85%	90%	100%
W. White Pine	45%	50%	55%	60%	60%	65%	70%	70%	75%	75%	80%	85%	90%

Decay Classes

Snag and log decay classes were placed into three structural classes as described by Bull et al. (1997 – figure 5). Decay class 1 refers to recent mortality. It is equivalent to snag decay stage 1 and log decay classes 1 and 2 as described by Nietro and Bartels et al. (in Brown 1985). Decay class 2 refers to snags that have been dead for a while and have lost some branches and bark or logs that are in contact with the ground and have lost some bark and branches. It is equivalent to Brown's snag decay stages 2-3 and log decay class 3. Decay class 3 represents snags and logs that have been dead for several years and are well into the decomposition processes or have been largely consumed by the fire. It is equivalent to Brown's snag decay stage and log decay classes 4 and 5.

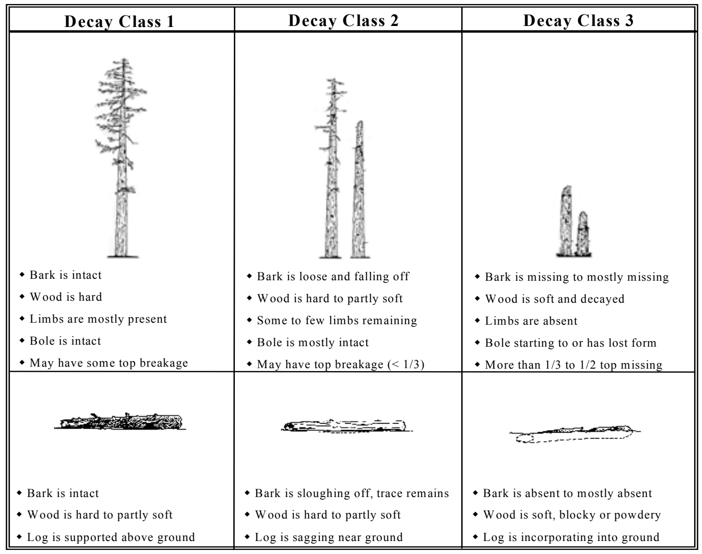

Figure 5D: Description of Decay Classes

Figure 6D: Transect 1-3, Unburned Early-Successional Forest (Strata 1)

Figure 7D: Transect 2-4, Unburned Mid-Successional Forest (Strata 2)

Figure 8D: Transect 3-1, Unburned Late-Successional Forest (Strata 3)

Figure 9D: Transect 4-3, Early-Successional Forest with Low-Moderate Intensity Burn (Strata 4)

Figure 10D: Transect 5-4, Mid-Successional Forest with Low-Moderate Intensity Burn (Strata 5)

Figure 11D: Transect 6-2, Late-Successional Forest with Low-Moderate Intensity Burn (Strata 6)

Figure 12D: Transect 7-2, Early-Successional Forest with High-Intensity Burn (Strata 7)

Figure 13D: Transect 8-5, Mid-Successional Forest with High-Intensity Burn (Strata 8)

Figure14D: Transect 9-5, Late-Successional Forest with High-Intensity Burn (Strata 9)

Results

An initial analysis for the overall landscape snag density was ran for all snags inventoried (≥10in dbh and all decay classes – Table 2D & 3D). Figure 37 (in the WEEP document) breaks down the snag data into finer categories based on diameter at breast height and decay classes.

Table 2D: Strata and Snag Statistics for the Landscape Sampling Stratum within the Pilot-Survey Area

Strata	Strata Size (Acres)	Average Density (#/Plot)	Standard Deviation (#/Plot)	Average In Acres (#/Acre)	Variance In Acres (#/Acre)	Strata Weight	Sample Size (n)
1	936	0.65	1.31	1.31	6.95	0.25	20
2	690	0.35	0.75	0.70	2.25	0.18	20
3	2166	5.15	2.87	10.36	33.35	0.57	20
4	556	1.30	1.45	2.62	8.56	0.11	20
5	1286	4.60	5.32	9.26	114.38	0.25	20
6	3304	10.75	6.63	21.63	178.09	0.64	20
7	1705	0.80	1.06	1.61	4.52	0.42	20
8	434	29.35	15.10	59.06	923.20	0.11	20
9	1904	32.75	19.81	65.90	1589.11	0.47	20

Table 3D: Stratified Statistics for each Landscape Area and Overall Levels of Snags (n =180)

Stratum	Stratified Mean	Stratified Variance	S_e	Bound	Upper Limit	Lower Limit	Confidence Level	Level of Precision
Unburned (1-3)	6.370	0.566	0.752	1.257	7.627	5.114	90%	20%
Low-Mod (4-6)	16.484	4.019	2.005	3.348	19.832	13.136	90%	20%
High (7-9)	38.053	18.089	4.253	7.103	45.156	30.950	90%	19%
Overall	20.244	0.121	0.349	0.582	20.827	19.662	99%	3%

Log levels were summarized similarly to snag densities, using the standard of feet/acre as the measure (WEEP, Figure 38).

Landscape Distribution

DecAID is a summary of the current knowledge and best available data on dead wood in Pacific Northwest ecosystems (Marcot et al. 2002). It suggests that decisions about how to distribute levels of dead wood across a landscape be guided by the distribution information from unharvested plots. Planning areas (landscapes or watersheds) should be sufficiently large to encompass the range of variation in wildlife habitat types and structural conditions. As a general rule-of-thumb they suggest that planning areas be at least 20 square miles in size (12,800 acres). A reasonable objective is to manage for the range of conditions within the planning area, based on the DecAID data, rather than focusing on a specific wildlife species. Over a landscape balancing high density areas of dead wood with moderate and low density areas may be desirable (Marcot et al. 2002).

The survey area is located within the westside lowland conifer-hardwood forest wildlife habitat type in the Oregon western Cascades subregion. Within it, the three structural condition classes (O'Neil et al. 2001) summarized in DecAID, are found. These structure condition classes change spatially through time, as a result of forest succession and disturbance processes (e.g., wildfire).

Based on an estimated natural spatial range of structure conditions within the survey area and data for landscape distribution of snags in natural conditions, an overall distribution for high snag densities was estimated. The results indicate that approximately 4-6% of the planning area should have snag densities in excess of 36 snags/acre (≥10in dbh). According to White et al. (2002), landscape levels prescriptions should incorporate extremes. Some portions of the landscape will have little to no dead wood, while other portions will have a great deal. They recommend leaving high densities in riparian areas, where it is naturally highest. This survey indicates that the current landscape distribution of snag densities at these levels is 16% (WEEP, Figure 39), which is about 10% higher than DecAID recommends.

Comparison with Forest Plan

In 1977 the U.S. Forest Service established a national snag policy requiring Forests to develop guidelines to "provide habitat needed to maintain viable, self-sustaining populations of cavity-nesting and snag-dependent wildlife species." (USDA 1977). The current standards and guidelines for snag management were created in 1990 (Umpqua National Land and Resource Management Plan) and amended by the Northwest Forest Plan in 1994. These plans require management of cavity-nesting species at or above 60 percent potential population capability (PPC) for the planning area. Habitat requirements vary by species (Table 4D).

Table 4D: Forest plan snag requirements and current levels. Current levels are higher than needed to maintain maximum potential population capability for cavity-nesting birds according to the Umpqua Forest Plan (USDA 1990 – Appendix B-73)

SPECIES	SNAG/100 ACRE			DBH (inch)	DECAY CLASS
	60% PPC	100% PPC	CURRENT		
Downy Woodpecker	10	16	91 (11-14")	11+	2-3
Red-breasted Sapsucker	27	45	558 (15-24")	15+	1
Hairy Woodpecker	115	192	27 (15-16")	15+	2-3
Northern Flicker	29	48	327	17+	2-3
Pileated Woodpecker	4	6	390	25+	1
TOTAL Snags/100ac	185	307	1,393		

The results of the inventory indicate that current snag levels are approximately 4.5 times higher than needed to maintain maximum (100%) PPC.

Spotted Owl Habitat Mapping

Interagency Vegetation Map Project (IVMP) products (Western Oregon Cascade Province Version 2.0) were used to create the large-scale owl habitat used for this analysis WEEP, Figure 32). A combination of tree size based on quadratic mean diameters (QMD) and conifer cover (PCT_CC) represent nesting/roosting/foraging habitat for the owl.

To develop the "rule set" for use with the IVMP data, owl pair core polygon coverages were compiled for the Western Cascades Oregon (WCO) province and overlaid on 10m-resolution SPOT satellite imagery from 1996 and edited for quality control. During this process, obvious errors were corrected (e.g., clearcuts, meadows, road corridors…etc.). This produced a more accurate polygon map delineating owl nesting/roosting habitat across the province. The next step was to further reduce erroneous data by converting this polygon coverage into a grid and "shrinking" the edges of these polygons by 2 pixels (or 50 meters). The resultant "core" areas (n=1,467 - 58,800 acres) were then used as "training sites" to classify IVMP grids.

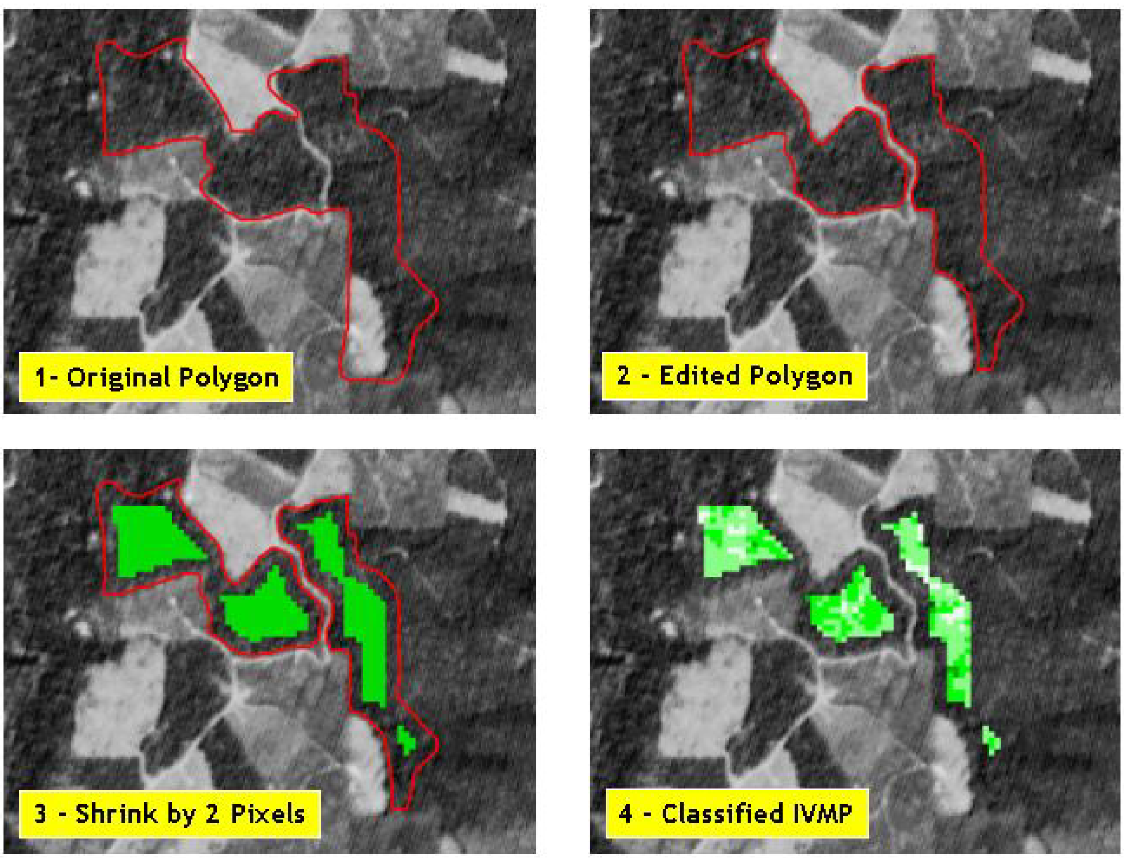

Figure 15D: An Example of the 4-Step Classification Process using Owl Cores

Table 6D: Summary of Provincial Classification of IVMP Data with Owl Cores

ATTRIBUTE	MEAN	-1SD	+1SD
QMD	30”	17”	42”
PCT_CC (Conifer)	92%	82%	100%

One standard deviation below the means were used as the “rule set”. This equates to QMD ≥ 17” and CC ≥ 82%.

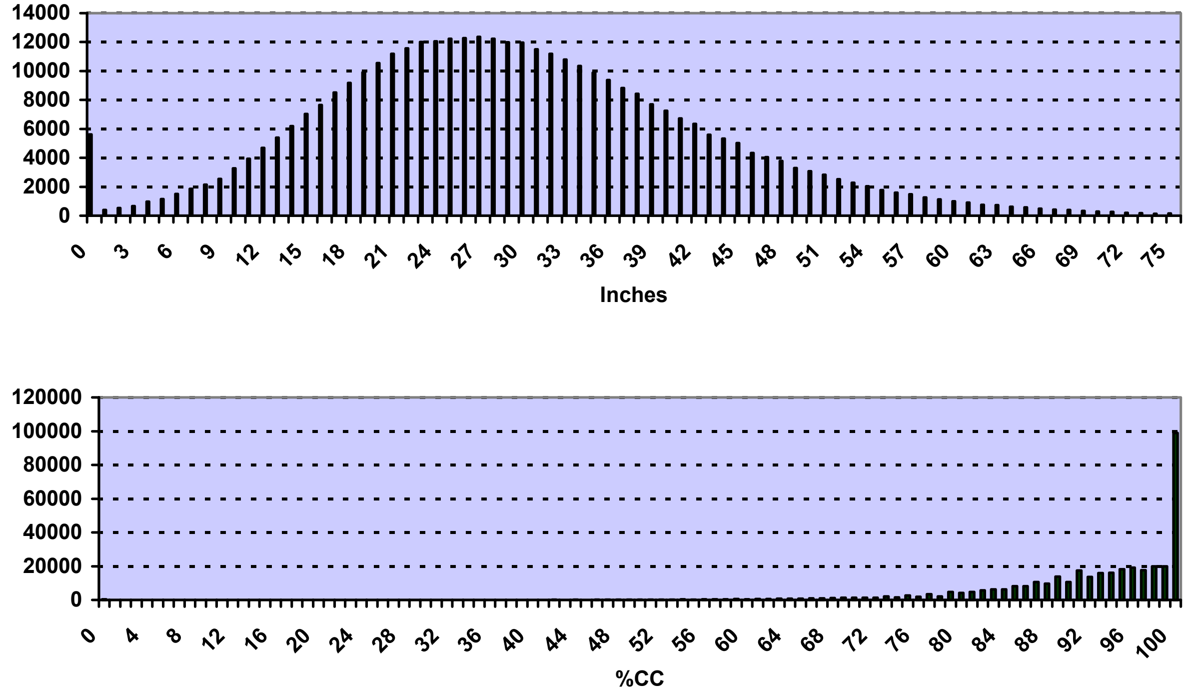

Figure 16D: Histograms of Owl Core QMD and PCT_CC (Conifer) for the Province

To complete the map, dispersal habitat was mapped using 11” d.b.h./40% CC rule (e.g., 50/11/40). Non-forested areas were then queried out and pixels not meeting the above categories are seral stages still too young to meet habitat parameters.

Table 7D: Mapping Attributes for the Owl Habitat Map

HABITAT TYPE	PARAMETERS	CODE
Nesting/Roosting	QMD ≥ 17” and PCT_CC ≥ 82%	3
Dispersal	QMD ≥ 11” and PCT_CC ≥ 40%	2

A neighborhood statistical analysis (focal sum) was used to quantify the spatial arrangement of habitat based on a moving 1.2 mile radius analysis “window” (equivalent to the owl’s home range). The spatial attribute is represented by a percentage value representing the percent of area within a home range from that point.

References

Bate, L.J., Garton, E.O. and M.J. Wisdom. 1999. Estimating snag and large tree densities and distributions on a landscape for wildlife management. Gen. Tech. Rep. PNW-GTR-425. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 76 p.

Brown, E.R. (ed.). 1985. Management of wildlife and fish habitats in forests of western Oregon and Washington: Part 1. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 332 p.

Bull, E.L., C.G. Parks and T.R. Torgersen. 1997. Trees and logs important to wildlife in the interior Columbia River Basin. Gen. Tech. Rep. PNW-GTR-391. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 55 p.

DeVries, P.G. 1986. Sampling theory for forest inventory: A teach-yourself course. Line-intersect sampling. Springer, Berlin (Chapter 13). pp. 242-279.

Marcot, B.G., K. Mellen, J.L. Ohmann, K.L. Waddell, E.A. Willhite, B.B. Hostetler, S.A. Livingston, C. Ogden and Tina Dreisbach. 2002. The DecAID repository: background information for DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. USDA Forest Service, Pacific Northwest Research Station and Pacific Northwest Region, Portland, Oregon.

O'Neil, T. A., D. H. Johnson, C. Barrett, M. Trevithick, K. A. Bettinger, C. Kiilsgaard, M. Vander Heyden, E. L. Greda, D. Stinson, B. G. Marcot, P. J. Doran, S. Tank, and L. Wunder. 2001. Matrixes for wildlife-habitat relationships in Oregon and Washington. CD-ROM. in: D. H. Johnson and T. A. O'Neil, editors. Wildlife-habitat relationships in Oregon and Washington. Oregon State University Press, Corvallis OR.

Reinhardt, E.D. and K.C. Ryan. 1989. Estimating tree mortality resulting from prescribed fire *in* Symposium proceedings: Prescribed fire in the Intermountain Region *edited by* Baumgartner, D.M., D.W. Breuer, B.A. Zamora, L.F. Neuenschwander and R.H. Wakimoto. Washington State University. 41-44.

USDA. 1977. Forest Service Manual - Title 2630.3 (Policy) - Wildlife Management.

USDA. 1990. Umpqua National Forest land and resource management plan. Pacific Northwest Region.

USDA/USDI. 1994. Record of decision (ROD) for amendments to the Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl; and standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl.

Waddell, K.L. 2002. Sampling coarse woody debris for multiple attributes in extensive resource inventories. Ecological Indicators 1:139-153.

White, D.E., T. Atzet, P.A. Martinez and L.A. McCrimmon. 2002. Dead wood and fire relationships in southwestern Oregon western hemlock forests. (pp. 479-487) In: W. F. Laudenslayer, Jr, P. J. Shea, B. E. Valentine, C. P. Weatherspoon, and T. E. Lisle (Ed.). Proceedings of the Symposium on The Ecology and Management of Dead Wood in Western Forests, 2-4 November 1999, Reno, Nevada. USDA Forest Service, Pacific Southwest Research Station General Technical Report PSW-GTR-181.

SNAG TABLE

Stratum: Enter the stratum number (e.g., 1, 2, 3, thru 9).

Location: Enter the plot number in for the transect.

Segment: Enter a single whole number to indicate which 328-foot transect length is being surveyed (e.g., 1 or 2).

Subsegment: Enter the corresponding number of the Segment that this 164-foot (50-m) transect length is nested within. For example, the two Subsegments nested within Segment 1 should be identified as Subsegment 1.1 and 1.2.

Distance: Enter the perpendicular distance between the midpoint of the qualifying snag and the center of the transect line to the nearest foot***. If no snag is encountered within the entire Subsegment, enter "9999" under distance***. It is critical to measure distances precisely. If the midpoint of a snag or tree falls directly on the boundary, include the first one, exclude the second one, and so on.

Species: Enter the corresponding numeric code of the snag species encountered.

Douglas-fir (*Pseudotsuga menziesii)*	202
Pacific silver fir (*Abies amabilis*)	011
White fir (*A. concolor*)	015
Grand fir (*A. grandis*)	017
Subalpine fir (*A. lasiocarpa*)	019
Shasta red fir (*A. magnifica* var. *shastensis*)	021
Noble fir (*A. procera*)	022
Incense cedar (*Calocedrus decurrens)*	081
Western redcedar (*Thuja plicata*)	242
Sugar pine (*P. lambertiana*)	117
Western white pine (*P. monticola*)	119
Ponderosa pine (*P. ponderosa*)	122
Western hemlock (*Tsuga heterophylla*)	263
Mountain hemlock (*T. mertensiana*)	264
Pacific yew (*Taxus brevifolia*)	231
Knobcone pine (*P. attenuata*)	103

Class: Enter the numeric value for the appropriate decay/structural class of the snag encountered.

D.B.H.: Enter the diameter at breast height of the snag or tree encountered using a D.B.H., stick or tape, to the nearest inch (minimum of 10 inch d.b.h.).

Height: Enter the height of the snag or tree to the nearest foot (minimum of 5 foot height).

Mortality: Enter the numeric code for the mortality condition of the snag/tree. If the tree is already dead, then code as "0". If the tree is expected to die soon due to fire damage, then code as "1".

LOG TABLE

Stratum: Enter the strata number (1, 2, 3, thru 9).

Location: Enter the plot number in which the transect is contained.

Species: Enter the corresponding numeric code of the snag species encountered.

Large End Diameter: Enter the diameter at the large end of the log using a D.B.H., stick or tape, to the nearest inch.

Small End Diameter: Enter the diameter at the small end of the log using a 16 inch minimum diameter.

Length: Enter the length of the log to the nearest foot. Again, use a 16 inch minimum diameter.

PLOT TABLE

Stratum: Enter the strata number:
1, 2, 3, thru 9.

Location: Enter the plot number in which the transect is contained.

Segment: Enter the segment number that contains the condition described. If the entire 656-foot transect is more or less homogenous, enter a "9999".

Subsegment: If there is a significant difference between subsegments, enter the subsegment number which contains the condition described, otherwise enter a "9999".

Series: Enter the plant series code that summarizes the entire plot (transect), segment or subsegement.

Intensity: Enter the numeric code for the fire intensity that summarizes the average condition for plot, segment or subsegement.

0 = Unburned
1 = Less than 40% of overstory trees killed
2 = 40 to 80% of overstory trees killed
3 = Greater than 80% of overstory killed

Severity: Enter the numeric code for the fire severity that summarizes the average condition for plot, segment or subsegement.

0 = Unburned
1 = Duff is largely intact, although it can be charred on surface. Woody debris partially consumed or charred
2 = Duff is deeply charred or consumed, but underlying mineral soil is not visibly altered, including fine roots near surface
3 = Duff is completely consumed and top of mineral soil is reddish or orange. Logs can be completely consumed or deeply charred. Soil surface texture is changed and fine roots near surface consumed or deeply charred.

SLOPE CORRECTION TABLE

HORIZONTAL DISTANCE	SLOPE					
	15%	30%	45%	60%	75%	90%
50 FT	51	52	55	58	63	67
100 FT	101	104	110	117	125	135
164 FT	166	171	180	191	205	221
328 FT	332	342	360	383	410	441
656 FT	663	685	719	765	820	883

LARGE SNAG & LOG INVENTORY FIELD FORM

STRATUM_________ PLOT#_____ DATE______________ SURVEYOR(S)________________________

PLOT SIZE______________ AZIMUTH________ UTM(X)______________UTM(Y)_________________

SNAG DATA (min dbh = 10in / min height = 5ft)

SEGMENT	SUB-SEGMENT	DISTANCE (FT)	SPECIES	CLASS	DBH (IN)	HEIGHT (FT)	MORTALITY	SERIES	FIRE INTENSITY	FIRE SEVERITY

LOG DATA (min dia = 16in / min length = 16ft)

SPECIES	CLASS	LARGE END (IN)	SMALL END (IN)	LENGTH (FT)

COMMENTS: